Appendix L: Rules for Designating Landbird Point Count Routes in ArcGIS

Jaime L. Stephens
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For choosing VCP sampling locations, we used an algorithm termed the Generalized Random Tessellation Stratified (GRTS) method to develop spatially balanced sampling locations within each selected sampling frame for each park. To establish a systematic random sampling route around each GRTS sample, 11 adjacent points are placed 250 m apart, according to a set of rules. These rules ensure that a grid is set up as closely around the GRTS sample as possible, using a systematic, random approach within constraints of the defined sampling frame. Depending on the sampling frame, the routes are established either in a block (matrix, alpine, wetland) or line (roads, streams).

For Non-linear Routes (CRLA, LABE, LAVO Wetland Sampling Frame, ORCA, RNSP):

1) Grids were built in ArcGIS placing points 250 m apart within a 1000 m radius on cardinal direction orientation, using Hawths Tools conditional point sampling tools. This provided plenty of potential points (47 points) to accommodate the selection process detailed below.

    a. If the GRTS sample is less than 125 m from the park edge, then the GRTS sample will be dropped and replaced with the next GRTS sample within the same time series.
    b. While following the subsequent rule set, if any point along a route is less than 250 m from a previously established point, it will not be included.
    c. If a point is less than 125 m from the park edge, it will not be included.
    d. Each route must be established within a contiguous piece of sampling frame (e.g., it can not cross a road) for CRLA, LABE, LAVO, and RNSP. This rule could not be met for ORCA.
    e. For any given route, the situation where the extra distance traveled between points (to travel around an area that is not included in the sampling frame [e.g., lava field]) cannot exceed 350 m total.
    f. If greater than 1/6 of the interior of the route is non-sampling frame (e.g., lava field), then the GRTS sample will be dropped and replaced with the next GRTS sample within the same time series.

2) From these grid points, build a block of eight points around the GRTS sample, with the GRTS sample in the center.

3) If not possible, role a die to choose a random direction in which to build a block of eight points with the GRTS sample in the center of one edge.

4) If not possible, role a die to choose a random direction in which to build a block of eight points with the GRTS sample in the corner of the block.

Appendix L. Rules for Designing Landbird Point Count Routes in ArcGIS (continued).

5) If not possible to fit an entire eight point block, build as much of it as possible using steps 2-4. Afterwards, refer to the next step for placing remaining points.

    a. If the establishment of the initial block is limited by a previously established point count route, the GRTS sample will be dropped and replaced with the next GRTS sample from the same time series.

6) Place remaining points to make a 12 point route (and an extra three points as oversamples) in sets of three around and adjacent to the grid, rolling a die for a random direction until all points are placed.

7) If sets of three do not fit around the grid, repeat rolling dice for random direction, for sets of two points until all points are placed.

8) If sets of two do not fit around the grid, repeat rolling dice for random direction, for one point at a time until all points are placed.

9) If no more points fit around the gird, choose points in a random direction by sets of three, then two, then one.

10) If the above criteria cannot be met, and thus 12 points (and three oversamples) cannot be fit contiguously within a block of the sampling frame, the GRTS sample will be dropped and replaced with the next GRTS sample within the same time series.

For Linear Routes (LAVO Stream Sampling Frame, WHIS):

1. Points are placed 250 m apart in both directions from the GRTS sample to form a 12 point route.

    a. If the GRTS sample is less than 125 m from the park edge, then the GRTS sample will be dropped and replaced with the next GRTS sample within the same time series.
    b. While following the subsequent rule set, if any point along a route is less than 250 m from a previously established point, it will not be included.
    c. If a point is less than 125 m from the park edge, it will not be included.
    d. For any given route, an extra 1000 m of road or trail distance between one point and the next is allowable. If this is exceeded, add points to the road/trail in the other direction as needed. For any given route, an extra 350 m of stream distance between one point and the next is allowable. If this is exceeded, add points to the stream in the other direction as needed.

2. If there are not road/trail/stream junctions, build a route with an equal amount of points on each side of the GRTS sample. Roll a die to determine which end of the route to add the last point to, to complete a 12 point route.

Appendix L. Rules for Designing Landbird Point Count Routes in ArcGIS (continued).

   a. If you cannot place a point due to proximity of a previously established route, continue along that road/trail/stream in the same direction until you reach the first possible place to put a point.
   b. If you cannot place a point due to proximity to the park boundary, add points to the road/trail/stream in the other direction as needed.

3. If there are road/trail/stream junctions encountered when designating the route, lay out the points as indicated in step 2 until you reach an intersection. At the intersection, role a die to choose a random direction to indicate which road/trail/stream the route will continue on.

4. If the road/trail/stream ends or you exceed the allowable extra travel distance, trace back to either:
   a. The first intersection you encounter going backwards and add remaining points; or
   b. If you do not encounter an intersection, add points to the end in the opposite direction from the GRTS sample.